

CLAIMS

1. A positive photoresist composition that is used in a method for forming a resist pattern that includes an exposure step using an electron beam, comprising
5 a resin component (A) that exhibits increased alkali solubility under action of acid, an acid generator component (B) that generates acid on exposure, and an organic solvent (C), wherein
said component (A) comprises a copolymer containing a first structural unit (a1) derived from hydroxystyrene and a second structural unit (a2) derived from a
10 (meth)acrylate ester having an alcoholic hydroxyl group, and a portion of hydroxyl groups of said structural units (a1) and alcoholic hydroxyl groups of said structural units (a2) are protected with acid dissociable, dissolution inhibiting groups.
2. A positive photoresist composition according to claim 1, wherein a weight
15 average molecular weight of said copolymer of said resin component (A), prior to protection with said acid dissociable, dissolution inhibiting groups, is at least 2,000 but no more than 8,500.
3. A positive photoresist composition according to claim 1, wherein at least 10
20 mol% but no more than 35 mol% of a combined total of hydroxyl groups of said structural units (a1) and alcoholic hydroxyl groups of said structural units (a2) are protected with said acid dissociable, dissolution inhibiting groups.
4. A positive photoresist composition according to claim 1, wherein a molar ratio
25 between said structural units (a1) and said structural units (a2) within said resin

component (A), prior to protection with said acid dissociable, dissolution inhibiting groups, is within a range from 95:5 to 75:25.

5. A positive photoresist composition according to claim 1, wherein said structural
5 unit (a2) is a structural unit derived from a (meth)acrylate ester containing an aliphatic polycyclic group having an alcoholic hydroxyl group.

6. A positive photoresist composition according to claim 5, wherein said structural
unit (a2) is a structural unit derived from a (meth)acrylate ester containing an adamantyl
10 group having an alcoholic hydroxyl group.

7. A positive photoresist composition according to claim 1, wherein said structural
units (a2) comprise only structural units derived from acrylate esters having an alcoholic
hydroxyl group.

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8. A positive photoresist composition according to claim 1, wherein said acid
dissociable, dissolution inhibiting group is a 1-lower alkoxyalkyl group.

9. A positive photoresist composition according to claim 1, wherein said copolymer
20 of said resin component (A) further comprises a third structural unit (a3) derived from
styrene.

10. A positive photoresist composition according to claim 1, wherein a polydispersity
(Mw/Mn ratio) of said copolymer of said resin component (A), prior to protection with
25 said acid dissociable, dissolution inhibiting groups, is no more than 2.0.

11. A positive photoresist composition according to claim 1, further comprising a nitrogen-containing organic compound (D), wherein said component (D) comprises a secondary or tertiary aliphatic amine containing an alkyl group of 7 to 15 carbon atoms.

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12. A method for forming a resist pattern, comprising steps of applying a positive photoresist composition according to claim 1 to a substrate, conducting a prebake, performing selective exposure using an electron beam, and then conducting post exposure baking (PEB), and performing alkali developing to form a resist pattern.

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13. A method for forming a resist pattern according to claim 12, further comprising a narrowing step, in which a water soluble resin coating comprising a water soluble polymer is provided on top of said resist pattern obtained following alkali developing, and is subsequently heated, causing said water soluble resin coating to shrink, thereby
15 narrowing a spacing of said resist pattern.